

Effect of Music Intervention on Independence in Activities of Daily Living
for Children with an Autism Spectrum Disorder

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Abstract

Article Keywords: autism spectrum disorder (ASD), preschool children, self-care activities of daily living (ADL), music intervention

Objectives

This study examined the effects of music intervention on performance of three activities of daily living (ADL) tasks by a child with an autism spectrum disorder (ASD) in the child's preschool classroom at school. Researchers explored the impact of this intervention on the child's ability to complete three self-care activities of daily living: putting on a jacket, handwashing, and eating with a spork.

Method

This single-subject study used an AB design to compare the simultaneous effect of listening to directive self-care songs on completing 3 target ADL by measuring changes in 18 target behaviors for a child with an ASD.

Results

Through visual analyses, positive changes were observed in handwashing and eating with a spork, while negative changes were observed in putting on a jacket. A clear pattern of change was observed in only 1 of the 18 target behaviors during intervention.

Conclusion

Music intervention may have an effect on target behaviors required to complete self-care ADL activities in a preschool setting for a child with an ASD, however, more research is needed.

For the reporting period of 2004, the National Center on Birth Defects and Developmental Disabilities of the Centers for Disease Control and Prevention (CDC) estimated that the prevalence rate for children diagnosed with an autism spectrum disorder (ASD) was about 1 in every 152 children, with at least 300,000 children between the ages of 4 and 17 diagnosed with an ASD (Rice, 2007). This number has increased in the most recent reporting period of 2006 to an average of 1 in 110 children, with an estimated 730,000 children between the ages of 0 and 21 diagnosed with an ASD (Rice, 2009). Rice (2009) also states that children with this diagnosis can experience a loss or regression of developmental skills. Although statistics are not available for the number of preschool children diagnosed with an ASD, it can be assumed that the prevalence rate for this age group has increased as well.

Likewise, the 2006 Census Bureau reported that 63% of all children under the age of five were in some type of regular childcare arrangement, with about 35% of these being with non-relatives at an organized care facility such as a day care, preschool, or head start school (Laughlin, 2010). The National Center for Education Statistics (NCES, 2009) reports that in 2007-2008, almost 5% of the total children ages 3-21 in school served under the Individuals with Disability Education Act (IDEA; 2004) are diagnosed with an ASD, an 800% increase from 1995-1996 when ASD was first served under the IDEA. Therefore, much of the burden of helping children with an ASD to meet developmental milestones falls upon on preschool teachers and assistant teachers. With teachers' busy schedules and limited training in inclusive methods for special needs children (Gould & Sullivan, 1999), it is likely that interventions that are both easy to

implement and effective would be beneficial for teachers working with individuals with an ASD.

Research has shown that preschool children diagnosed with an ASD have difficulty participating in activities of daily living (ADL) due to delayed sensory motor development (Jasmin, Couture, McKinley, Reid, Fombonne, & Gisel, 2009). Deficits in sensory motor skills also lead to challenges in completing simple self-care activities independently (Jasmin et al., 2009). A range of interventions have been explored with this population in occupational therapy, but effective and evidenced based treatments are needed, specifically in areas that use structured approaches, environmental modifications, sensory integration techniques, and promote independent living for individuals with an ASD (Case-Smith & Arbesman, 2008). Incorporating the use of routines in daily activities with preschool and elementary aged children has been shown to aid caregivers, teachers and therapists in helping children diagnosed with an ASD to learn new skills or function more independently both at home and in schools (Kern, Wolery, & Aldridge, 2007; Laushey, Heflin, Shippen, Alberto, & Fredrick, 2009).

Some research has identified music therapy as a means for preschool and school aged children with an ASD to participate and interact without using verbal language (Gold, Wigram, & Elefant, 2006). The emotional tone of music can allow someone with an ASD to express him or herself and engage in a non-verbal conversation with others through dance, movement, and song, thus interacting socially while responding appropriately to the environment. Music has been shown to promote independence, assist in transitions, participate in social interactions and help establish routines for young

children with autism (Kern et al., 2007), but there is limited research identifying the effects of music interventions on self-care activities.

Occupational therapy practitioners are professionals who often work with children diagnosed with an ASD on interdisciplinary teams to evaluate, plan interventions, and administer programs to individuals with this diagnosis. Occupational therapists (OTs) have the opportunity to incorporate music during their therapy sessions to create added sensory input and stimulate responses of children to therapy both in schools and clinics (MacRae, 1992). The use of music and simple, traditional songs with directive lyrics maybe helpful in teaching individuals with an ASD to complete activities. However, there is little research addressing the use of music intervention to promote independence in self-care activities such as eating, grooming, bathing, dressing and toileting.

Background

Typically developing preschool children. The preschool years are characterized by the development of independence and transitions from the home to the school. Most typically developing 4, 5, and 6-year old children have mastered skills such as putting on a front-button coat, washing hands independently and self-feeding with a spoon (Mulligan, 2003). Mulligan (2003) also reports that children of this age are usually proficient at zipping up their jacket, washing hands with very few cues, and eating with a spoon or fork with occasional spilling. Preschool children are required to perform these skills in environments or with care providers where they may not be comfortable or familiar (Mulligan, 2003). Similarly, preschool children with an ASD are often required to perform these self-care skills in unfamiliar environments with care providers, but are

often unsuccessful due to neurodevelopmental factors impacting their ability to learn these skills (Rogers, 2005).

Preschool children with an ASD. In typically developing children, brain development occurs through experience and learning; individuals with an ASD experience limited development in areas related to communication and interaction skills (Rogers, 2005). Therefore, preschool children with an ASD typically have difficulties with effective communication, social interaction, and meeting developmental milestones. Their impaired ability to use verbal language, comprehend others, and appropriately respond to situations inhibits their ability to accurately express their feelings (Gold et al., 2006). Young children diagnosed with an ASD have an especially difficult time following verbal directions (Gold et al., 2006). Periods of the day when transitions occur, such as washing hands after toileting or putting on a jacket to go outside, or learning new skills such as using a utensil when eating, can therefore be very difficult for these children.

Sensory processing difficulties ASD. Research has shown that sensory-based interventions may help to reduce maladaptive behaviors and hyperactivity, inhibit self-stimulation and repetitive movements, and improve attention and focus for children with an ASD (Escalona, Field, Singer-Strunck, Cullen, & Hartshorn, 2001; Field et al., 1997). Dawson and Watling (2000) determined that the presence of sensory processing abnormalities and impairments in fine and gross motor skills are relatively frequent in individuals with autism. Because only four studies on the effectiveness of sensory-integration treatments were found (Case-Smith & Bryan, 1999; Linderman & Stewart, 1999; Reilly, Nelson & Bundy, 1984; Ray, King & Grandin, 1988) and results were

inconsistent, Dawson and Watling (2000) concluded that more research on techniques that seek to improve sensory processing and fine and gross motor functioning of individuals with an ASD was warranted.

Difficulty with modulating sensory input is a common challenge for many children diagnosed with an ASD. In a study conducted by Tomchek and Dunn (2007), 281 preschool children with an ASD were compared to their typically developing peers using the Short Sensory Profile (McIntosh, Miller, & Shyu, 1999) to investigate sensory processing differences in this population. Researchers found that 95% of the children with an ASD were reported as having some degree of sensory processing abnormality. Results indicated that children with an ASD had the greatest difficulty in auditory filtering (e.g. difficulty paying attention and appearing to hear what someone says), under-responsive/seeks sensation (e.g. seeking movement that interferes with daily routine), and tactile sensitivity (e.g. expressing distress while grooming). Researchers concluded that results indicated that the sensory processing difficulties experienced by these children also had an impact the child's ability to perform self-care activities and ADL.

Auditory processing difficulties ASD. Although auditory processing disorder (APD) is not part of the criteria for diagnosis of an ASD, many children with ASD have auditory processing problems (Paul, 2008). APD is the inability to detect and discriminate between sounds and sound patterns. The auditory processing difficulties of children with an ASD are related to their ability to attend to stimuli rather than the ability to discriminate different sounds (Paul, 2008). One sensory-based intervention used to address auditory processing difficulties with both APD and ASD is auditory integration

training (AIT). AIT has been proposed for children with an ASD as a way to decrease hypersensitivities that can interfere with occupational engagement.

Research has shown some positive outcomes with AIT such as decreases in reported behavior problems (Dawson & Watling, 2000). Dawson and Watling (2000) found that four of six studies using AIT reported a decrease in behavioral problems with the lowest functioning individuals having the greatest changes. This evidence suggests that auditory processing and sensory interventions have positive outcomes affecting behavior in children with an ASD. Although, researchers did not examine the use of AIT to strengthen self-care activities or activities of daily living (ADL), the results of improved behavior in children with an ASD indicates the possibility of using auditory-based interventions such as music to improve the behavior of children with an ASD.

ADL skills. An ADL is any activity that is essential to living and allows basic survival of the individual (American Occupational Therapy Association, 2008). Preschoolers are in the process of learning and mastering basic self-care ADL skills such as dressing, eating, and hygiene. Research has shown that children with an ASD have more difficulties with eating and mealtimes than typically developing children. Schreck, Williams, & Smith (2004) found that children with an ASD had more feeding problems, including being more likely to refuse food, require specific utensils and types of food, or eat pureed foods. Specific research on mealtime behaviors of children has identified differences between typically developing children and children diagnosed with an ASD. In a case-controlled study, Provost, Crowe, Osbourn, McClain & Skipper (2010) matched 24 pairs of typically developing preschool children and preschool children diagnosed with an ASD by age, gender and ethnicity to observe for mealtime behaviors. In this

study, researchers found that children diagnosed with an ASD had more difficulty eating at school ($p = .008$) and at restaurants ($p = .001$) than typically developing children. Specific mealtime behaviors that children with an ASD had difficulty with included: resisting sitting at a table ($p = .02$), having frequent tantrums ($p = .03$), throwing or dumping their food ($p = .04$), being a picky eater ($p = .01$), and having problems with gagging ($p = 0.03$). These difficulties indicate a need for interventions that help children with this diagnosis to engage and participate more appropriately in mealtime behavior.

In Jasmin et al. (2009), problems with ADL were identified in preschool children with an ASD using four standardized assessments. These assessments included the Functional Independence Measure for Children (WeeFIM; Uniform Data System for Medical Rehabilitation, 1998, 2000), the Survey Interview Form of the Vineland Adaptive Behavior Scale—Second Edition (VABS-2; Sparrow, Balla & Cicchetti, 2005), the Peabody Developmental Motor Scales—Second Edition (PDMS-2; Folio & Fewell, 2000), and the Sensory Profile (Dunn, 1999). In this study, two trained occupational therapists administered these tests to thirty-five 3 and 4-year-old children in a study conducted at Montreal Children's Hospital in Quebec. Overall researchers found that poor functional independence for children with an ASD is related to and partially caused by their poor sensory responses and fine motor difficulties.

Jasmin et al. (2009) hypothesized that there was a relationship between emotion, attention, and sensory processing and found fairly strong, significant correlations between sensorimotor performance and ADL (WeeFIM self-care $r = 0.47$, $p = .04$; VABS-2 ADL $r = 0.49$, $p = .003$). Fairly strong significant correlations between the WeeFIM and VABS were also found in sensory avoiding ($r = 0.40$, $p = .02$) and auditory processing ($r = 0.37$,

$p = .04$) during self-care activities. Overall, researchers found that these children performed poorly on both the WeeFIM (49 % = -2 SD) and VABS-2 ($-1 \text{ SD} < x < -2 \text{ SD}$) in areas of ADL skills and that these deficits also impacted the independence of these children. The results of this study allowed researchers to recognize the need to develop interventions attempting to normalize sensory responses and improve motor skills in ADL for children with an ASD.

Rhyming interventions. Interventions such as rhyming storybooks and therapeutic songs were examined in a literature review of case studies to identify instances of improvement in social skills with children who have an ASD (Pasiali, 2004). In this literature review, researchers found that these individualized strategies and the use of rhyme and rhythm help children with an ASD to communicate and acknowledge safety risks more effectively. Researchers recommended that OTs use directive or descriptive rhyming sentences written in first person to help the child to be more receptive to these interventions. No research examining this intervention to improve self-care skills was found.

Music interventions. The SCERTS model is currently being adopted by music therapists to create treatment goals and objectives within a multidisciplinary team (Prizant, Wetherby, Rubin, & Laurent, 2003). The SCERTS model is comprised of three domains: social communication, emotional regulation, and transactional support. In a study by Walworth (2007), a survey was conducted to identify areas and activities in which music therapists utilized the SCERTS model in their practices. The survey was sent to American Music Therapy Association (AMTA) members throughout the country and 21 music therapists responded reporting services provided to 135 clients, 31% of

whom were 2-5 years old. Results of this survey indicated that music therapists reported using this model with self-help activities of daily living, though specific activities were not identified. This suggests that music is being used to address ADL by music therapists, however, the impact of this intervention has not been measured in evidenced based research and the author did not identify the use of this model with children diagnosed with an ASD.

In Kaplan and Steele (2005), individuals with an ASD were able to generalize activity-based skills learned in music therapy sessions to non-music therapy environments such as the home or school. In this study, a computer program measured outcomes-based data on the participants' ability to achieve goals and objectives over a two-year therapy period including activity-based music activities to address behavioral/psychosocial and language areas. Multiple types of music therapy sessions including individual, partner, small group, large group, peer model, and combination sessions occurred, however the frequency of these sessions is unknown. Of the 40 participants, 100% met their first objective within the first year. The participants ranged from 2-49 years of age, however the study did not indicate the number of participants who were preschool age. In addition, activity objectives were not specified and no statistical analyses were presented. However, the positive results of this study suggest that music therapy may be helpful in goal setting and effects may be generalized to other activities for individuals with an ASD.

Routine and Music. Music has been utilized in conjunction with routine to promote independence during transitional periods in an early childcare program (Kern et al., 2007). Teachers used music to help structure routines for two children with an ASD

during transition periods, particularly morning arrival time and separating from parents. The music was personalized to each student, composed by a music therapist, and the lyrics conveyed the demands of a five-step morning routine. An A-B-A-B design for student #1 and a modified A-B-A-B format for student #2 were used. The results showed increasingly independent responses to music during interventions and some improvement in the child's ability to enter the class, greet the teacher and other individuals, and wave goodbye to their parent. Routine use of music also showed positive effects on peer interactions and participation in activity. However, music was never implemented during functional activities such as eating, grooming, bathing, dressing, or toileting.

In a study by Stephens (2008), positive effects in social communication and engagement from imitation techniques in predictable routines with children with autism have also been shown using musical interventions. The children in this study were all rated mild-moderate on the Childhood Autism Rating Scales (CARS; Schopler, Reichler & Renner, 1988). Participants were observed as they mimicked and repeated words used by the researcher during musical dance and instrument play. The researcher used an A-B-A-B design, in which the intervention phase consisted of the researcher directing and positively reinforcing the participant verbally while moving to music with the child and stopping at musical pauses. The researcher's verbal and directive actions included "wave," "pat," "rub," and "push," the children were observed as responding to these directives and completing the action or not. Spontaneous imitation and social participation increased for all subjects. However, there was no evidence of generalization beyond training sessions, and the lyrics of the music used in the study did not include the directive actions given by the researcher. Though this study identified positive effects

from routine music interventions, the directive motions did not address completion of ADL, suggesting a need for more research in this area.

Children with an ASD commonly have poor ADL skills (Jasmin et al., 2009). Other typical deficits that children with an ASD have, such as communication, social skills, and safety awareness, have had positive results from interventions involving sensory processing, auditory processing, music, and routine. It has been reported that music therapists have used music as an intervention to improve ADL skills, however there is no current research to support the effect of this intervention on children diagnosed with an ASD. There is very limited research describing the use of music as an intervention used by occupational therapists, however, it has been identified as a tool that can be used by OTs within their practice (MacRae, 1992). The purpose of the current study, therefore, is to determine the effect of song-directed routine activity on the performance of ADL by preschool children diagnosed with an autism spectrum disorder. The research question that this study sought to answer was “Can simple music with directive lyrics help preschool children diagnosed with an ASD to be more independent or perform better on three self-care activities in a school setting?”

Method

Research design

An A-B-A-B multiple baseline across behaviors and subjects, single subject experimental design was initially chosen for this study. This design was chosen to identify differences in performance between baseline (A phase without music) and intervention (B phase with music) conditions. The single subject multiple baseline design minimizes threats to validity by measuring performance across three dependent

variables—hand-washing, eating with a spork (combinations spoon and fork), and putting on a jacket. A total of three subjects were sought after to participate in this study in order to further minimize threats to validity.

Multiple factors required the necessity to modify the study to an A-B design. The main factor affecting this change was limited time remaining in the academic school year due to complications in gaining approval from the school district prior to implementation. The result of these complications was delayed approval by the Institutional Review Board (IRB) of the University of Puget Sound. The design was modified in order to use the available time remaining in the school year for longer phases with more data collection periods per segment, rather than using the original design, which would have resulted in four shorter phases with only about five data collection periods per segment. This design also accounted for national and school holidays that took place during the timeframe of this study.

Due to the time constraints, design changes, and planned holidays, modifications to the scheduled number of data collection periods during the study also needed to be made. Data collection was originally scheduled to occur three times-per-week during an eight-week period in the designated classroom at the elementary school. This schedule and time period were changed after IRB approval was first granted. Therefore, these modifications were brought to the attention of the IRB for further approval. The final schedule for data collection resulted in four data collection periods per week during a five-week study. These modifications to the schedule and time period for the study were approved by the IRB prior to beginning recruitment.

Recruitment

This study took place in a special education preschool classroom at a local public elementary school in the Puget Sound region of Washington State. This location was chosen because of a connection with the Special Education Coordinator in the district and the professors at the University of Puget Sound. The Special Education Coordinator recommended an elementary school based on the number of classrooms in the school with children fitting the age and diagnosis requirements.

The primary researcher was given names of multiple teachers in three different classes at the elementary school to determine interest in participating in this study. These teachers were then contacted over the phone. All teachers were informed of the study and given the choice to participate or not. All teachers contacted were willing and very excited to take part in this study. The primary researcher then met with two of the three teachers to explain the study further after which it was determined that these two classes were not ideal locations to recruit participants because of the lack of students meeting all requirements of this study. The third teacher, who was contacted over the phone, was able to identify possible participants that would meet the inclusion/exclusion criteria for this study. The primary researcher then delivered the recruitment materials and within one week this teacher sent the recruitment materials home in the backpacks of the possible participants.

The recruitment materials consisted of an information flyer and two copies of a consent form. The information flyer included a brief description of the study and contact information of the primary researcher. This flyer directed the parent/caregiver to contact the primary researcher if they were interested in having their child take part in this study. All participants were successfully recruited in this manner.

Prior to recruitment, the researchers considered the additional requirement of gaining informed assent directly from study participants. This consideration was brought to the attention of the IRB. Ultimately, given the cognitive profile of most children with an ASD, it was the researchers' position that for a 4-6 year-old child with this diagnosis and typical clinical presentation, informed assent would not be meaningful.

Inclusion/Exclusion Criteria

Participants were required to be between the ages of 4-6 years old and enrolled in the classroom identified to participate in this study. Participants were required to have received a DSM-IV diagnosis of ASD by a child psychologist, pediatrician, neurologist, or diagnostic team, which was confirmed via verbal report of the parent. Participants were screened with selected portions of the Pediatric Evaluation of Disability Inventory (PEDI; Haley, Coster, Ludlow, Haltiwanger, & Andrellos, 1992); that included questions regarding the three DVs addressed in this study to determine the participant's current status of ability to complete the three DVs. Finally, participants were required to be screened via parent report by the primary researcher with the Social Responsiveness Scale (SRS; Constantino, 2002), and were required to be classified by this assessment as having an ASD.

Participants would be excluded if they were receiving school-based occupational therapy treatment addressing all three DVs during the time of this study. Children with verbal confirmation by the parent of past medical history including auditory sensitivities to loud noises or hearing difficulties, presence of a childhood disintegrative disorder, Rett's Syndrome, physical disabilities, or other medically diagnosed genetic disorders were excluded from this study. These diagnoses were excluded to avoid confounding

variables impacting the results of this study. These variables include (but are not limited to): misclassification of an ASD due to the presence of similar characteristics or negative psychological effects on the participant.

Participant

The population of interest for this study was preschool and kindergarten children, ages four to six, diagnosed with an ASD and currently having difficulty developing age appropriate independence in using a utensil while eating, obtaining soap and washing/drying hands, and putting on and zipping or fastening a jacket as identified by the PEDI (Haley et. al., 1992). Ideally, participants were to include a total of three children, representing varying degrees of severity on the autism spectrum (mild/moderate and severe) as identified by the SRS (Constantino, 2002).

One boy, age 3 years, 10 months participated in this study. This child was initially considered as a back-up participant (due to the fact that he did not meet the age requirements of the study) who would be enrolled if other students meeting the eligibility criteria could not be found. The decision to consider this child as a back-up participant was made by the primary and secondary researchers during the recruitment period. At the time of recruitment, only one other family submitted a completed consent form, however the family was unavailable for contact to complete the screening process. Due to time restrictions, recruitment was discontinued and the back-up child was enrolled into the study by the primary researcher. It was confirmed during initial screening that this participant met all inclusion/exclusion requirements except for the age criteria.

The participant's father was contacted via telephone, at which time he verbally confirmed that the boy had been previously diagnosed as having an ASD by their family

physician. Through administration of the PEDI (Haley et. al., 1992), it was confirmed that the boy was able to finger feed, but was unable to use any sort of utensil while eating. During handwashing the boy could rub his hands together, but was unable to turn the water on/off, obtain soap, or wash and dry his hands thoroughly. While putting a jacket on the boy could push his arms through the sleeves and assist with fasteners and the zipper, but was unable to put on the jacket himself. The SRS (Constantino, 2002) was administered during this interview to confirm the diagnosis of ASD. The participant received a T-score of 66 on the SRS (Constantino, 2002), placing him in the mild to moderate range for ASD.

Instrumentation

In order to gather data on the child's level of independence in self-care activities, parent report of the child's current self-care skills was obtained using selected questions from the self-care and social function domain sections of the PEDI (Haley et. al., 1992). Only the skills sets that were in direct relation to this study were presented to the parent. These skills sets included: food textures, use of utensils, handwashing, pullover/front-opening garments, fasteners, and problem-resolution. Information gathered from this parent report was used to determine if a child was appropriate for this study. Further information regarding the questions used from this assessment can be found in Appendix A.

The SRS (Constantino, 2002) is used to assist in the screening for and diagnosis of an ASD (Constantino et al., 2003). It includes 65 questions that are scored on a four-point Likert scale, and is able to be completed by a parent/caregiver or teacher who knows the child well. This assessment measures the severity and type of social

impairments and symptoms observed in children across the spectrum. The purpose of administering this test was to confirm the verbal report by the parent of the presence of an ASD.

Intervention

In this study, the independent variable (IV) of music intervention was used to observe for changes to the dependent variables (DV) of performance on the three target self-care activities. The intervention consisted of using songs with directive actions to promote the completion of these self-care activities. During development of the study, the primary researcher attempted to find songs that could be used to target development of the three DVs in this study, but was unsuccessful in this attempt. Thus, the primary researcher and a songwriter, who was contracted for three compositions, created one song for each self-care activity under examination. These songs were recorded onto a compact disc (CD) with the permission of the creators, and this CD was played for the participant during each intervention session of this study. This CD was recorded onto a laptop computer for use as a secondary device in the event of a broken or lost CD player at the school. The teacher and participant were allowed to sing along with the CD if they so chose.

Music. The primary researcher chose well-known children's songs based on her knowledge and musical background and 7 years of preschool classroom experience where music was played and/or sung on a daily basis. The primary researcher wrote new lyrics for the three songs, and the songwriter modified the melodies using a keyboard instrument. It is important to note that these revisions were made prior to the primary researcher's knowledge of the children's ASD severity levels for whom the songs would

be played during the study. For this reason, the songs were written with task specific lyrics that could be implemented with a broader population, negating the possibility to personalize the music to participants.

The songs used words that correlated with the self-care activity that was to be performed with the song. The three songs used in this study included: “I Go and Wash My Hands” (Fillmore & Fillmore, 2010), sung to the tune of “So Early Sunday Morning;” “Oh When It’s Time To Eat My Food” (Fillmore & Fillmore, 2010), sung to the tune of “Oh When the Saints Go Marching In;” and “If You Want To Go Outside, Get Your Coat” (Fillmore & Fillmore, 2010), sung to the tune of “If You’re Happy and You Know It.” The lyrics verbally directed the participant through the steps of each activity while the teacher and participant performed the task. Use of directive lyrics was based on the rationale that by performing actual self-care activities in real situations while listening to directive songs, the participant might improve upon their acquisition of these self-care skills, and possibly increase his independence in these activities (Prizant et. al., 2003). The lyrics of these songs can be found in Appendix B.

Dependent Variables. A “Self-Care Skills” worksheet was developed as the primary data collection tool for this study. This tool can be found in Figure 1. The primary and secondary researchers developed this tool, and carefully chose the three self-care activities that would become the DVs. A variety of self-care activities were considered in choosing the final DVs, the researchers initially considered: use of drinking containers, toileting, brushing hair, brushing teeth, and dressing, as well as the three DVs observed in this study. A variety of factors went into determining the DVs. These factors included (but are not limited too): the ease of ability to observe the activity in a classroom

setting, measurability of change, ease of scoring an activity, likelihood of an activity already being completed in a classroom setting, considerations of appropriate self-care activities in a classroom setting, ability of a teacher to assist participants with the activity while being observed by the researcher, etc.

To develop this tool, the primary researcher conducted a task analysis on each of the three DVs. The major steps of each task became the target behaviors on the Self-Care Skills worksheet. This worksheet includes a total of 5 sections. Each section can be completed independently from the other sections, and no specific order was determined in which to complete observation of the DVs. Each DV required a different scale in order to accurately document the participant's performance.

"Putting on a jacket," was rated using a 5-point Likert scale for each step in this activity. "Washing hands," was rated yes or no for "able" or "unable," respectively, to complete target behavior according to whether the participant completed the steps of the task. "Eating with a Spork," was rated for holding the spork, bringing the spork to the mouth to eat, and picking up the spork. A specific utensil was not determined on the Self-Care Skills worksheet, and the utensil used at the school was a spork, and so this was the utensil used in this study.

The Self-Care Skills worksheet also included three additional sections. These were: 1) a place to record the initial activity level of the participant and the class, 2) the teacher's report of the child's temperament that day, and 3) a notes to document factors that may have impacted the observation period. The first section was included specifically to document the child's emotional state immediately prior to the observation of the three activities. The second section was included to gain perspective from the

teacher of any differences in the child's behavior from their usual temperament (e.g. was the child sick, or especially focused that day, etc.). This information was included to help the researcher to determine if other environmental or behavioral factors were affecting the participant's ability to complete the DVs.

Training. The teacher and two regular classroom assistants received brief verbal instruction in the methods by which the primary researcher would be observing the child's actions during these activities, and expectations of their participation in this study. The primary researcher modeled how to assist the participant in the three DVs for the three staff members prior to beginning the study. No training was given to the assisting staff member on the specific methods of assistance. This was due to the primary researcher's lack of knowledge of classroom specifics prior to beginning the study as well as time constraints. The teacher and regular assistants declined the opportunity to listen to, and learn the lyrics of the songs prior to beginning the intervention. The teacher and classroom assistants were allowed to choose whether to sing along with the songs when they were played.

During the study, substitute classroom assistants frequently attended data observation periods and at times took part in the study. The teacher, classroom assistants, and substitute assistants who assisted in the study were all given the following minimum specifics of the study: it was explained to the substitute that one teacher or assistant teacher should be available to help the participant during each activity, and that they should let the participant attempt to complete the activities independently before helping him. All classroom staff assisting the participant were told that verbal cueing would be allowed during the activities only after it was determined that the participant was unable

to complete the activity otherwise. Substitute classroom assistants were not instructed that they had the option to sing the songs with the participant.

Reliability. In order to maintain consistency and reliability, the primary researcher created a protocol and coding system for collecting data and for completing the Self-Care Skills worksheet. These protocols and the Self-Care Skills worksheet were modified and finalized by the primary and secondary researchers through a process of trial and revision. These protocols were followed at each observation period by the primary researcher who was observing the participant. The Coding System and Protocol for the Self-Care Skills worksheet and data collection can be found in Appendices C and D respectively.

The primary and secondary researchers rated videotaped samples of children performing each DV following the protocols written for this study to determine inter-rater reliability (IRR). A total of seven typically developing children with ages ranging from 3-10 years old were observed as they completed at least one of the DVs. Of these seven children, four children completed all three DVs and three children completed only one. Of the three children who completed only one DV, two children completed the DV of putting on a jacket, and the other child completed the DV of eating with a spork. One video of a child who completed all three DVs was observed on two different dates, resulting in a total of eight episodes viewed and scored to calculate IRR. The target behaviors of the three DVs observed during these eight episodes were compared between raters ($n = 101$) and percent agreement was calculated using the kappa statistic (Portney & Watkins, 2009). On this pilot assessment, the primary and secondary researchers were in 85% agreement with chance eliminated ($K = 0.851$). This data was analyzed using SPSS

using a two-way mixed model intraclass correlation coefficient with statistical significance ($ICC = 0.912$). This pilot assessment took place prior to beginning recruitment for the study.

Procedures

Prior to beginning this study, all recruitment materials, assessments and intervention tools were approved by the UPS IRB. The primary researcher then met with the Special Education Coordinator, and recruitment began at the elementary school.

During recruitment, the primary researcher explained the study in detail, and answered any questions that the parent had about the study or the consent form. The parent was directed to sign a copy of the consent form and return it to the school and keep one copy for himself. After this form was retrieved and reviewed by the primary researcher, the father was interviewed to confirm inclusion/exclusion criteria and complete screening assessments over the phone. All inclusion/exclusion information was obtained via parent/guardian report during this screening interview. After recruitment ended without acquiring other participants, it was confirmed that this participant would take part in this study and a date was set for data collection to begin.

Data Collection. During the data collection periods, the primary researcher recorded data on the Self-Care Skills worksheet as specified by the protocol for each DV. Data collection followed the routine of documenting 1) the participant's activity and emotional level and emotional level of class during the first five minutes after entering the classroom; 2) the teacher/classroom assistant report of how the participant's disposition had been for the day and documenting response; 3) handwashing following the bathroom routine; 4) spork use while eating; 5) putting on a jacket in preparation to

transition outside or putting on jacket to go home (if not previously documented). The total time frame to complete this routine for each data collection period required a total of 35 to 45 minutes.

To maintain consistency and reliability during both phases, data for the three DVs were collected only for the duration of time required to play the song that went with each DV. This was 1 minute, 23 seconds for handwashing, 2 minutes, 19 seconds for spork use, and 1 minute, 28 seconds for donning jacket.

Baseline and intervention. During the baseline phase the primary researcher recorded the participant's ability to complete each task. The baseline phase occurred during the first two weeks of the study. The primary researcher maintained the option of shortening or lengthening the baseline phase in response to stability in the target behavior (McMillan, 2004). This resulted in seven data collection periods for baseline phase. During the music intervention phase, observation continued in the presence of the IV during the self-care activities. Intervention data were collected during the final three weeks of the school year. This resulted in a total of six data collection periods for the intervention phase.

Data analysis

Baseline and intervention data were compared for different target behaviors across the three DVs. In order to conduct analyses using the SPSS program, all data were converted to numerical values in whole numbers. The scores from the activity of Putting on a Jacket were changed from 0, 0.25, 0.5, 0.75, and 1.0 to 1, 2, 3, 4, and 5 respectively. For the activity of Washing Hands, items were given a score of 2.0 if the participant was able to complete a target behavior, or 1.0 if the participant was unable to complete a

target behavior. To score Eating with a Spork, the number of tally marks for each target behavior was counted for each observation period and the resulting value was used as the score for that data collection period. Baseline data were graphed using SPSS statistics prior to beginning the intervention phase to observe for trends and to determine when to move from baseline to the intervention phase. The decision to move from baseline to intervention was made by the primary researcher once trends were observed in the majority of the target behaviors during a minimum of six observation periods.

Data for the three DVs were graphed using Microsoft Excel 2004 for Mac and analyzed visually to observe for changes or patterns in data. This method was chosen as visual analysis is used most often to analyze data in single subject research designs because changes are easily observable to the reader (Portney & Watkins, 2009). The scores for each target behavior were graphed for each observation period as a single dot on the date that the target behavior was observed. Mean values were calculated for the baseline phase (BP) of each target behavior and compared to the results of the intervention phase (IP). These mean values can be found on the legends of the graphs in Figures 2 through 8.

Three types of statistical analyses were conducted—the split middle line method with a binomial test (Portney & Watkins, 2009), the two standard deviation band method (Portney & Watkins, 2009) and correlation statistics. Trends in baseline data were calculated and graphed for each target behavior, and a celeration line was plotted using the split middle line method. Using this analysis, two or more consecutive points plotted either above or below the celeration line during intervention indicated significant results. In addition, the two standard deviation band method (Portney & Watkins, 2009) was

calculated and graphed to determine significance for any single data point plotted outside two standard deviations above or below the mean. The band is indicated by a flat dotted line with a shaded area above or below it on each graph with at least one data point that plotted outside of this band. Finally, correlation statistics were run on target behaviors and music intervention using Pearson Free Statistics Software (Wessa, 2010). Daily classroom observations were analyzed using Pearson correlation statistics to compare the teacher report of the participant's daily mood with the target behaviors of each DV.

Results

The participant took part in a total of 13 out of a possible 20 data collection periods. The seven missed data collection periods were due to sickness and absences by the participant. As a result, the planned return to baseline phase, was eliminated in order to have enough data collection periods during the intervention phase to observe for trends.

Unplanned events occurred on two data collection periods causing changes to the typical data collection routine. A fire drill occurred at the beginning of one data collection period causing a delay in scheduled activities, loud exciting noises, and changes to the daily routine. On another day high emotional activity levels of students in the class led the teachers to initiate snack time, prior to toileting and washing hands.

Visual analysis

Visual analyses were performed and results revealed that the participant's performance improved in seven target behaviors with music intervention. Graphs of these data are presented in Figures 2 through 8.

Statistical analyses

Change in target behaviors was further analyzed by comparing the means of baseline and intervention data. Average scores improved from 1.0 to 1.5 in getting soap, 1.14 to 1.5 in throwing a paper towel away, 1.43 to 1.67 in turning off the water, 1.5 to 2.17 in pushing the second arm through the sleeve, 1.4 to 1.83 for zipping coat, 2.14 to 8.83 in picking food up with a spork, and 0.29 to 7.67 in bringing the spork to the mouth. See Figures 2 through 8.

Statistical analyses of data using the two standard deviation band method (Portney & Watkins, 2009) indicated significant changes from the baseline phase to the intervention phase in five target behaviors (see Figures 5 through 9). Positive changes were seen in obtaining soap, throwing the paper towel away, picking up food with the spork, and bringing the spork to the mouth. Of these four behaviors, picking up food with the spork also showed improvement when analyzed with the split-middle line method with a binomial test ($p = .032$; Portney & Watkins, 2009). A decline of the participant's ability to complete the target behavior was seen in connecting the zipper on a coat.

Pearson correlation statistics were calculated and interpreted according to the standards identified by Portney and Watkins (2009) for all items measured. Good to excellent correlations with music intervention occurred with bringing the spork to the mouth ($r = 0.95$) and in picking up food with a spork ($r = 0.82$). Moderate correlations were observed with music intervention and throwing the paper towel away ($r = 0.66$), and in getting soap ($r = 0.59$). Fair correlations were also found in rubbing soapy hands together for more than one second ($r = 0.31$) and drying hands with a paper towel ($r = 0.31$). There was little correlation between putting the second arm through the sleeve and the IV ($r = 0.25$). A negative correlation was expected and observed for frequency of

spork use, however, correlation statistics resulted in a very low correlation for this factor ($r = -0.20$). Some target behaviors including grabbing the correct coat ($r = -0.58$) and connecting the zipper on the coat ($r = -0.51$) had moderate negative correlations. All other items had little or no relationship observed via statistical analysis.

Daily Observations.

During data collection periods, the participant was observed participating in activities such as playing with a car, reading a book, coloring, or listening to music with the class prior to engaging in the target behaviors. The initial atmosphere of the classroom, and the behavior of the subject were consistently observed at low (sitting quietly and not engaging in any activity) or medium levels (actively engaging in an activity). During the intervention phase, the participant frequently showed signs of listening to the music such as bobbing his head or body in a dancing manner, or staring at the stereo and smiling as it played the songs for each activity.

The teacher reported that the typical mood of the participant ranged from “good” to “a little hyper” to “hyper” to “extremely hyper.” These were verbal reports in response to the question of how the participant’s behavior had been that day. The teacher used very little elaboration to describe these reports other than an example for one period, a generalization of the day of the week on another, and the use of a hand gesture indicating a high level of activity on another period. The primary researcher also observed hyper behaviors such as running through the class, quickly and repeatedly opening and closing cabinet doors, repeatedly changing from activity to activity without apparent focus for more than a few seconds. Pearson correlation statistics were used to compare these four verbal descriptions to the seven target behaviors where changes were found. Moderate

correlations were found in bringing the spork to mouth ($r = 0.59$) and picking up food with the spork ($r = 0.58$), both these correlations were statistically significant ($p = .03$, two-tailed test).

Observed assistance by teachers and teaching assistants

During the study, the lead teacher and two teaching assistants took part in helping the student complete the three self-care activities. The assisting teachers consistently used verbal cueing for numerous target behaviors while washing hands. Verbal cues were inconsistently used when directing the participant to begin to put on his jacket and to zip up the coat. No assistance was given during the DV of eating with a spork. Neither the teacher nor teaching assistants were observed singing any of the songs during data collection.

Discussion

The limited number of data collection periods for both phases of the study may have had a negative impact in accurately measuring the effects of this treatment. The absences of the participant may have limited the participant's opportunity to respond to the routine of the music intervention used in the study. It is possible that phases not hindered by frequent absences would have resulted in more consistent and significant findings. Although the study incurred a variety of factors limiting its effectiveness, some positive outcomes were suggested through statistical analyses.

Using the standard deviation band method, five factors showed definite change from baseline to intervention periods, four of these being positive changes. The participant's performance greatly improved on behaviors related to eating with a spork. He was consistently able to scoop food with the spork and bring it to his mouth to eat

when the music intervention was in effect. In addition, Pearson coefficients suggest these changes were significantly correlated to the music intervention, suggesting that this method can be useful in helping children develop this skill. He also showed significant improvement in obtaining soap and throwing a paper towel away and was fairly consistent in his ability to complete these two skills at the conclusion of the intervention condition. It appears that the participant improved in these four behaviors as a result of the intervention, however, it is not known whether the routine or the music had more of an effect on the results.

Observations also supported the finding of improvement in Eating with a Spork. During baseline, the subject frequently picked up food pieces with his hands, placed them on the spork, and usually dropped the pieces of food before closing his mouth on the spork. During music intervention, the participant more readily used his spork to scoop food and more easily brought the food to his mouth without dropping the pieces. It is not known if the improvement in this behavior is directly related to the music intervention, the increased opportunity to practice spork use, or some other factor. However, the participant made gestures such as cocking his head while eating during music intervention, a sign the primary researcher interpreted as active listening by the participant. Therefore, it is possible that the music helped the participant to focus on eating his food during this activity.

The primary researcher observed the participant appearing to calm and become able to better focus on the tasks he was attempting to complete during music intervention. Observed behaviors included decreased nonsensical verbal language, decreased distractions and play during the activities, increased focus on the source of the music, and

increased use of the spork while eating. However, these behaviors were not consistent throughout all data collection periods, and it cannot be determined if the music intervention led to these behaviors.

It was apparent during daily observations that the participant enjoyed the songs. The participant was frequently observed to smile and make gestures such as nodding his head to the music or attempting to dance while songs were played. Although the songs may have encouraged him to take part in the activities with more enthusiasm, it is not known if the directive nature of the lyrics helped the subject to improve on the activities being observed.

While directive in nature, the lyrics themselves seemed to have little or no effect on the participant's behavior during data collection periods. Only during a few instances was the participant observed to complete the target behaviors of each activity when directed to do so by the song. The lyrics may have had a different effect had the teacher or teaching assistant sung the songs to further direct the participant in the target behaviors. Therefore, more research is needed to determine the extent to which directive lyrics can impact self care behaviors.

The two standard deviation band method indicated negative changes in response to the music for grabbing the correct coat. Though the participant made motions in baseline to grab his coat, he was consistently unable to get the coat off the hook during music intervention. Negative correlations between the music intervention and the two behaviors in putting on a jacket indicated that the participant did not always perform better with music intervention. Also, many of the graphs indicated inconsistencies in the subject's performance during music intervention on the target behaviors of putting the

first and second arms into the armholes, zipping up the coat, rinsing hands in the water, and turning off the water. Therefore it was difficult to determine the extent of the effect music may have had on these behaviors without longer data collection phases and return to baseline.

It is important to note that the two factors in which the participant's performance showed negative correlations, grabbing the correct jacket and zipping the jacket, might have been affected by other factors as well. The participant inconsistently received verbal cuing on these two factors, which may have affected the results. Behaviors observed during data collection periods indicated that the student had difficulty with transitions. These behaviors included running in the class, opening cabinet doors, and taking out new activities during transition periods between classroom activities. It is possible that the participant had more difficulty focusing on grabbing the correct jacket as this came at a time of transition from another activity. Furthermore, the music may have been a distraction at times during this target behavior. In this case, it may have limited the participant's ability to focus on connecting the zipper as well, an activity that typically requires a lot of concentration as it is a difficult part of putting on a jacket.

Limitations

A variety of internal factors limited the findings of this study. First, only one participant was recruited. A second child began recruitment, but the parent of that child was unable to be contacted to complete the interview process. The participant completed the study, but was not consistently present due to illness and absences creating a limited number of data collection periods. This inconsistent attendance may have affected the impact of the IV on the participant's performance. The lack of a to return to baseline

phase also limited this study. Other threats to reliability included differences in teacher's assistance given to the participant, inconsistency in teachers involved in this study, and changes made to daily routines due to unplanned events. Inconsistent volume levels on the music played during intervention may have affected the results, as the classroom was ill equipped with a working stereo, requiring the use of a secondary device with limited volume controls and speaker system. Only one data collector was able to observe the activities of this study, and although inter-rater reliability was measured prior to beginning the study, there is a possibility of researcher drift.

Implications for Occupational Therapy

Children with an ASD often have difficulties completing self-care ADL (Jasmin et al., 2009). As observed by the participant's actions in this study, music can encourage participation in self-care ADL for an individual with an ASD. Occupational therapists can use simple songs, like those used in this study, to direct individuals with an ASD through completion of self-care ADL. Simple songs such as these can be used in routines, a method that has shown to be useful with individuals with an ASD (Kern et al., 2007). OTs can also educate parents or teachers about the benefits of music interventions. Songs such as these can be easily taught and utilized by others to help an individual to generalize these skills from the clinic to the home or school. By simply using music in therapeutic practice, it is possible that activities can become more fun and engaging for the child, and perhaps produce better results than without music intervention.

Future Research

More research is needed to determine the extent of the impact music may have on task performance for individuals with an ASD. The results found in this study need to be

replicated and expanded in future work involving more participants. Future work should use designs that include return to baseline and intervention phases. This study could also be further developed to include other self-care activities that individuals with an ASD typically have difficulty with such as toileting, brushing hair, brushing teeth, or dressing. It is recommended that future research be extended to include the home or clinic settings in addition to the school to observe for differences between environments. It is recommended that future extensions of this study include an increased number of data collection periods in order to have more robust data. Future extensions of this study should include an additional phase where teachers and/or teaching assistants sing the lyrics to the participant(s) in order to measure the effect of this part of the intervention.

Summary and Conclusion

The results of this study indicate that music may have had an effect on the participant's performance of some of the target behaviors leading to gains in the three corresponding ADL. However inconsistencies were noted and some target behaviors showed no difference (putting the first and second arms into the armholes, zipping up the coat, rinsing hands in the water, and turning off the water), while others showed negative responses to the music (grabbing the correct coat and connecting the zipper). Due to significant limitations in this study, results cannot be generalized to the larger population of individuals with an ASD, thus further examination should be conducted before drawing conclusions about the effectiveness of this method. Because of the considerable changes noted in the three target behaviors, this intervention should be considered by therapists when designing interventions involving preschool age individuals with an ASD in special education classrooms at local schools.

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Table 1

Results of Putting on a Jacket

Date	Music Intervention	Grabbing (Getting) Coat	Arm One	Arm Two	Connect Zipper	Zip Coat
5/17/10	No	1	2	2	NA	NA
5/18/10	No	NA	NA	NA	3	NA
5/20/10	No	3	5	1	3	1
5/21/10	No	3	4	5	3	1
5/24/10	No	1	3	3	3	1
5/25/10	No	1	5	2	3	4
5/27/10	No	3	2	2	1	5
6/3/10	Yes	1	2	2	1	3
6/4/10	Yes	1	5	2	1	3
6/7/10	Yes	1	2	5	1	3
6/8/10	Yes	1	2	2	3	1
6/15/10	Yes	1	5	5	3	2
6/17/10	Yes	1	5	3	1	5

Note. No statistical significance observed on findings for this activity.

Table 2

Results of Washing Hands

Date	Music Intervention	Getting Soap	Rubbing Soap	Turning Water Off	Drying Hands	Throwing Paper Towel Away
5/17/10	No	1	1	1	1	1
5/18/10	No	1	1	1	1	1
5/20/10	No	1	1	1	1	1
5/21/10	No	1	1	2	1	1
5/24/10	No	1	1	1	1	1
5/25/10	No	1	1	2	1	1
5/27/10	No	1	1	2	1	2
6/3/10	Yes	1	1	2	1	NA
6/4/10	Yes	1	2	2	1	2
6/7/10	Yes	1	1	2	1	1
6/8/10	Yes	2	1	1	1	2
6/15/10	Yes	2	1	2	2	2
6/17/10	Yes	2	1	1	1	2

Note. Statistical significance observed in “Getting Soap” and “Throwing Paper Towel Away” using the Two Standard Deviation Band Method.

Table 3

Results of Eating with a Utensil

Date	Music Intervention	Picking Up Food with Utensil	Bringing the Utensil to Mouth	Picking Up the Utensil
5/17/10	No	2	1	1
5/18/10	No	2	0	3
5/20/10	No	5	1	3
5/21/10	No	0	0	3
5/24/10	No	0	0	1
5/25/10	No	0	0	1
5/27/10	No	6	0	7
6/3/10	Yes	11	9	1
6/4/10	Yes	8	7	1
6/7/10	Yes	8	9	3
6/8/10	Yes	6	6	1
6/15/10	Yes	13	10	1
6/17/10	Yes	7	5	5

Note. Statistical significance observed in “Picking Up Food with Utensil” and “Bringing the Utensil to Mouth” using the Two Standard Deviation Band Method. Statistical significance also observed using split-middle line method with a binomial test for “Picking Up Food with Utensil” ($p = .032$).

Subject _____

Date _____
Time observed _____

Self-Care Skills Worksheet

A. Activity level of the class (low = quiet; medium = active; high = emotional/loud): _____

Activity level of the subject (low = quiet; medium = active; high = emotional/loud): _____

Specific activity of the subject: _____

- B. Putting on jacket
1. Grabs correct coat
 2. Pushes first arm through sleeve
 3. Pushes second arm through sleeve
 4. Does adult hold coat? (Y/N)
 5. Connecting zipper
 6. Zips up coat
 7. Snaps coat

Yes/ No	D/ UN: 0	25% I: 0.25	50% I: 0.50	75% I: 0.75	I: 1.00	Not ob.	NA

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- C. Hand washing
8. Turns water on
 9. Obtains soap
 10. Rubs soapy hands for ≥ 10 sec
 11. Rinses hands until soap is off
 12. Turns water off
 13. Dries hands with paper towel
 14. Throws paper towel away
 15. Dries with item other than paper towel

Yes	No	NA

- D. Utensil use
16. Picks up food with utensil
 17. Brings utensil to mouth
 18. Frequency spoon/fork use

Frequency observed (in tallies)

E. Mood of participant (as stated by the teacher):

Notes:

Researchers initials _____

Figure 1. "Self-Care Skills Worksheet."

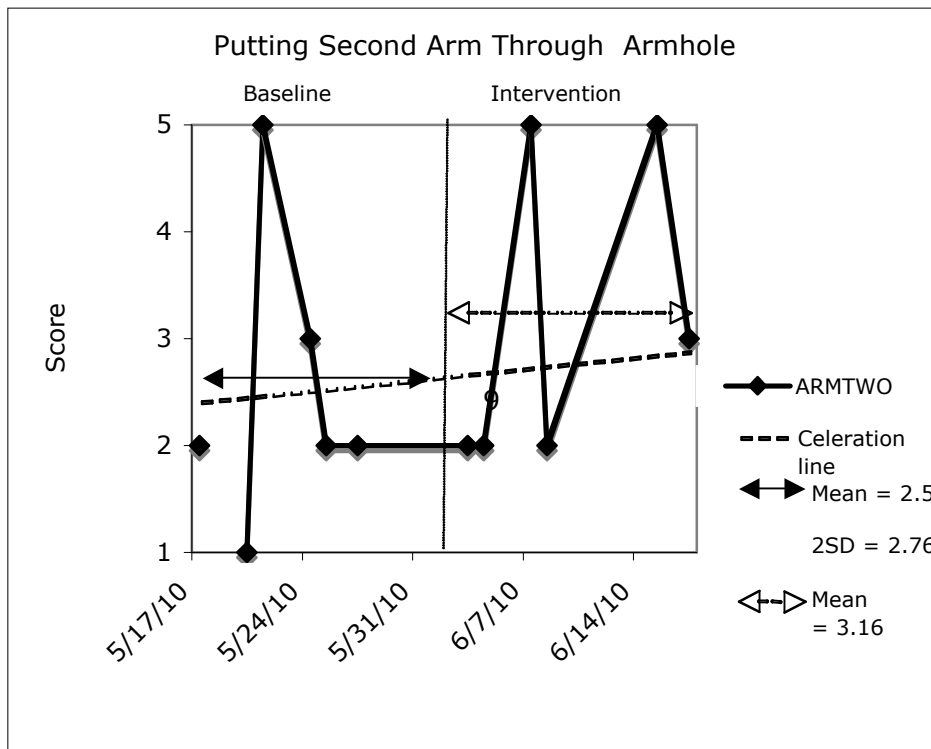


Figure 2. Results of the target behavior of putting second arm into armhole from DV of putting on jacket. *Note.* Only six baseline data collection periods, unconnected line represents missing data collection point for this target behavior.

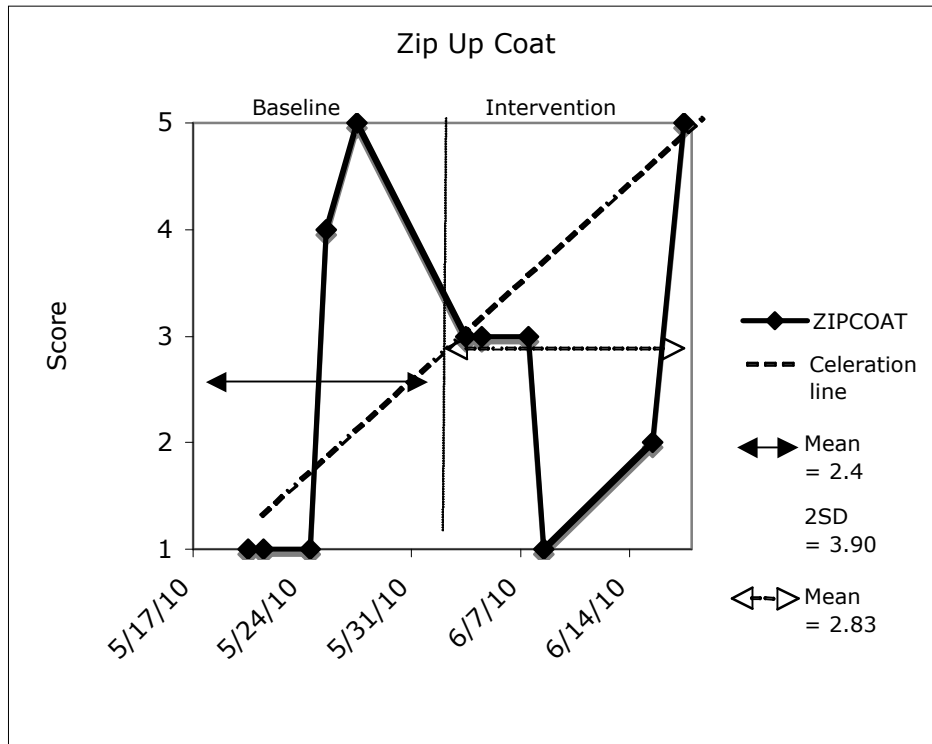


Figure 3. Results of the target behavior of zipping coat from DV of putting on jacket.

Note. Only five baseline data collection periods, missing data collection points for this target behavior occurred during first two data collection periods.

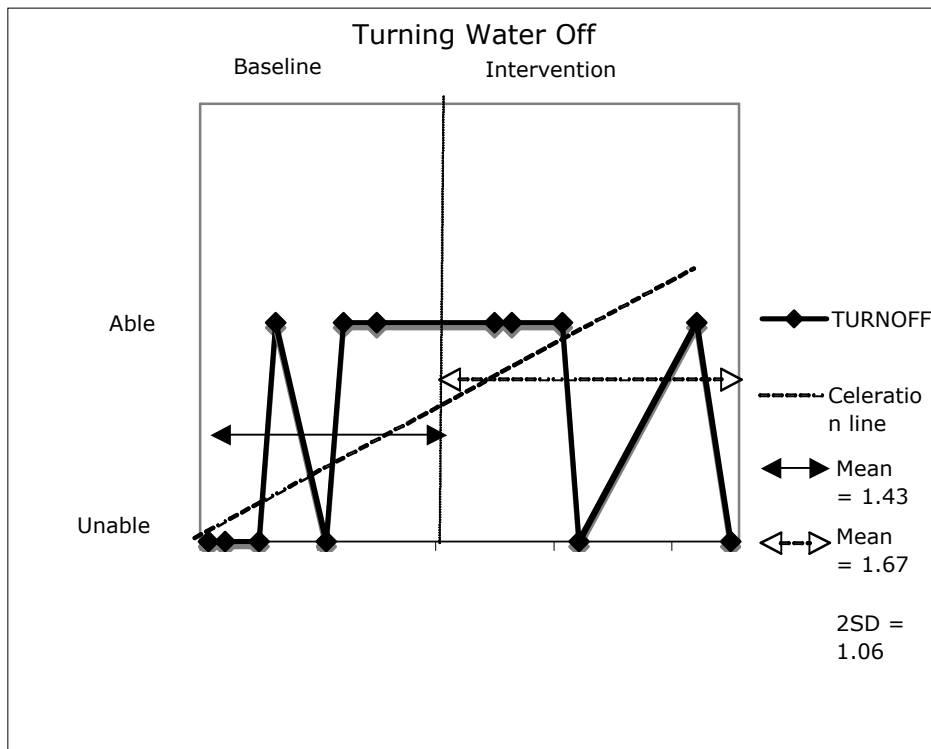


Figure 4. Results of the target behavior of turning water off from DV of handwashing.

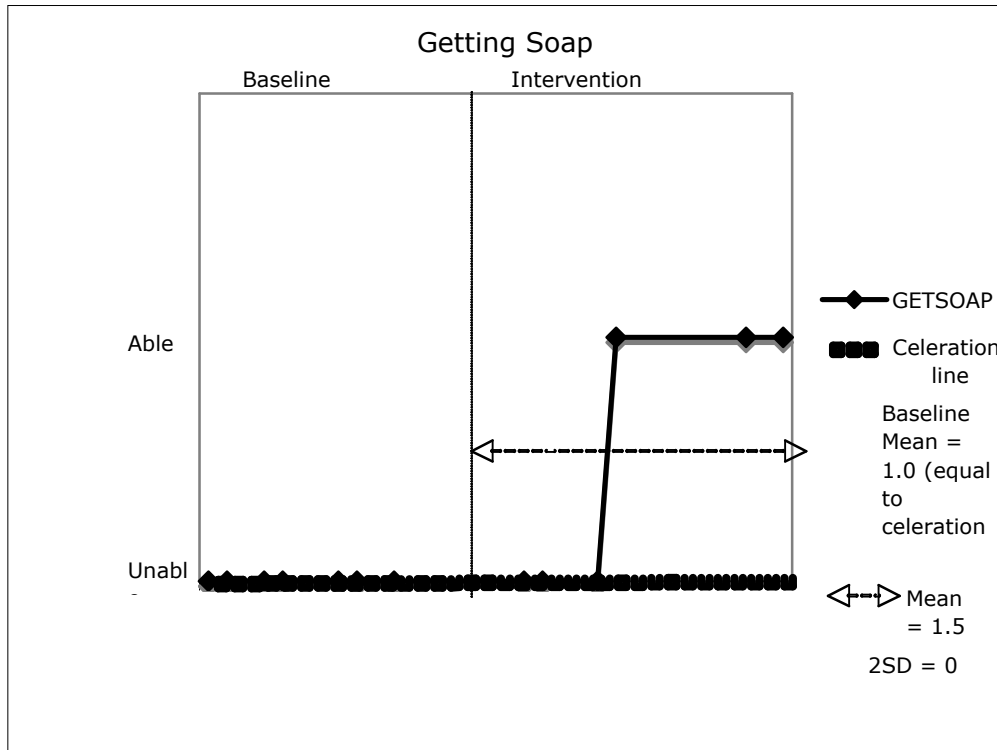


Figure 5. Results of the target behavior of retrieving soap from DV of handwashing.

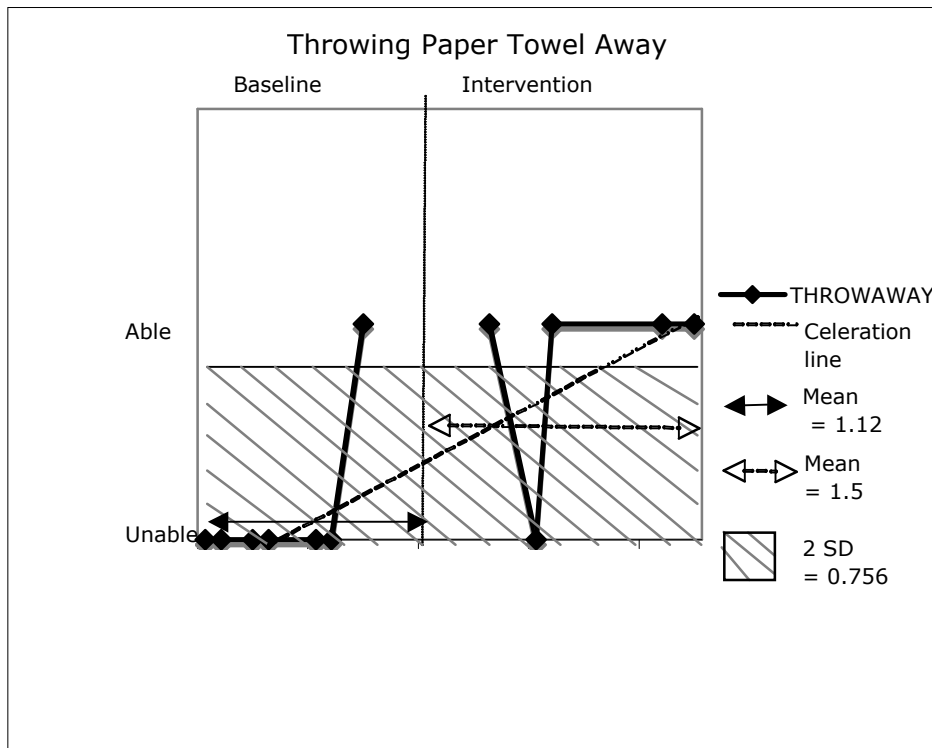


Figure 6. Results of the target behavior of throwing paper towel away from DV of handwashing. *Note.* Only five intervention data collection periods, unconnected line represents missing data collection point for this target behavior.

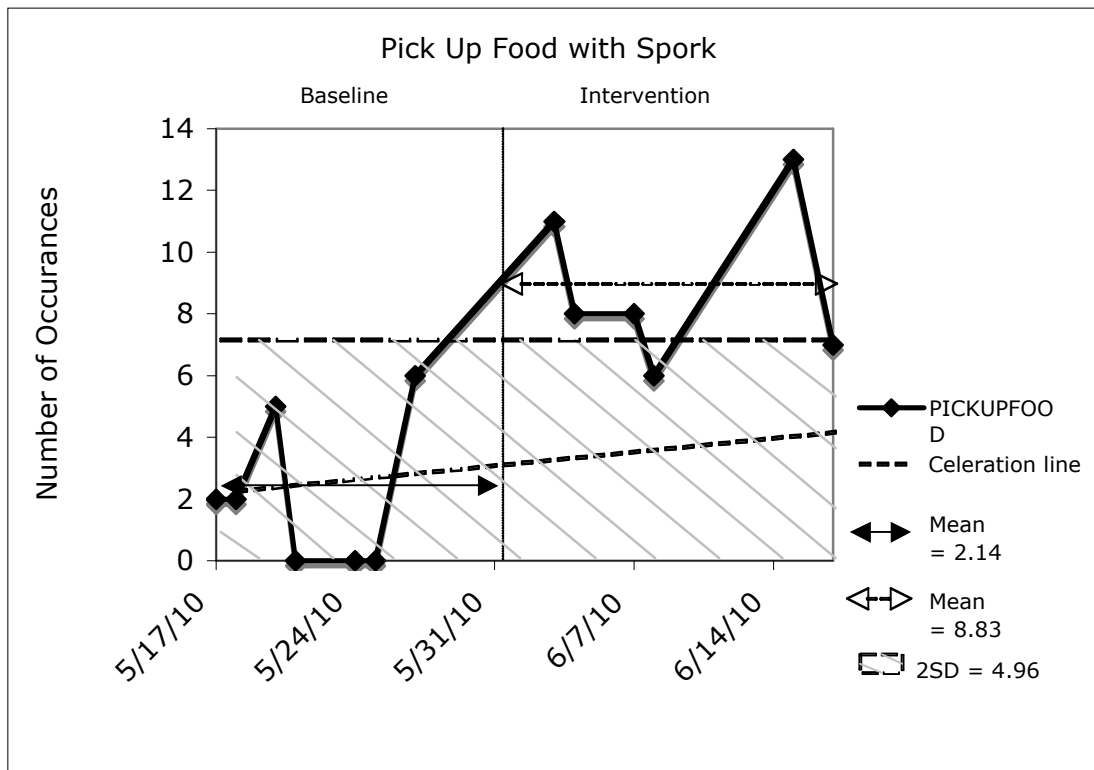


Figure 7. Results of the target behavior of picking up food with spork from DV of eating with a spork.

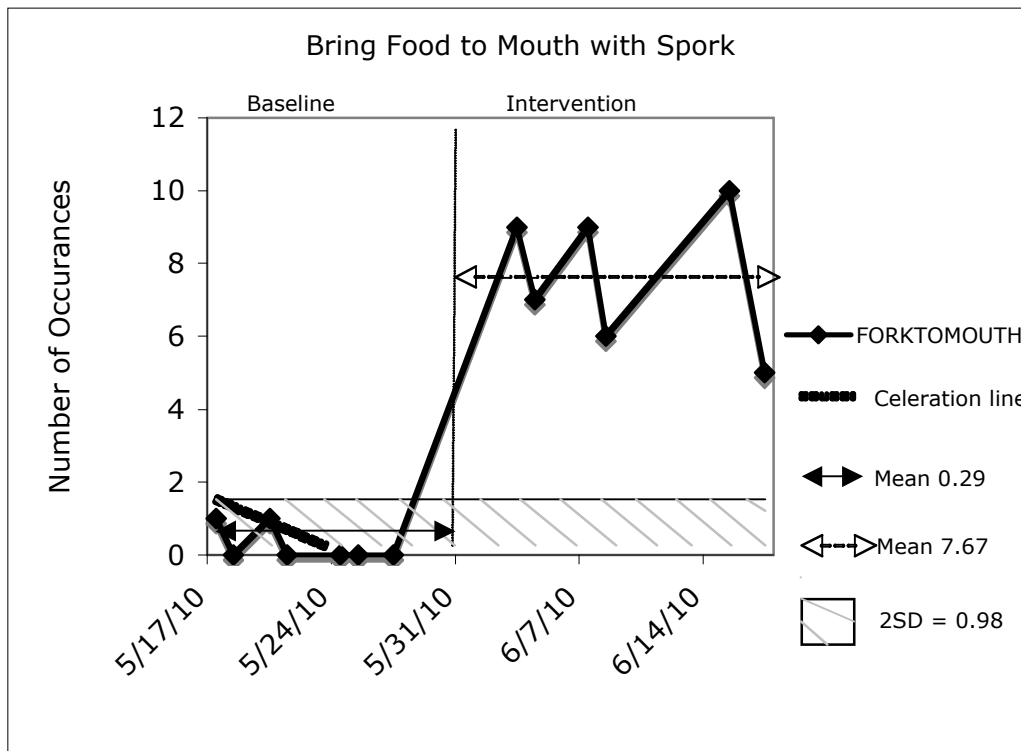


Figure 8. Results of the target behavior of bringing spork to mouth from DV of eating with a spork.

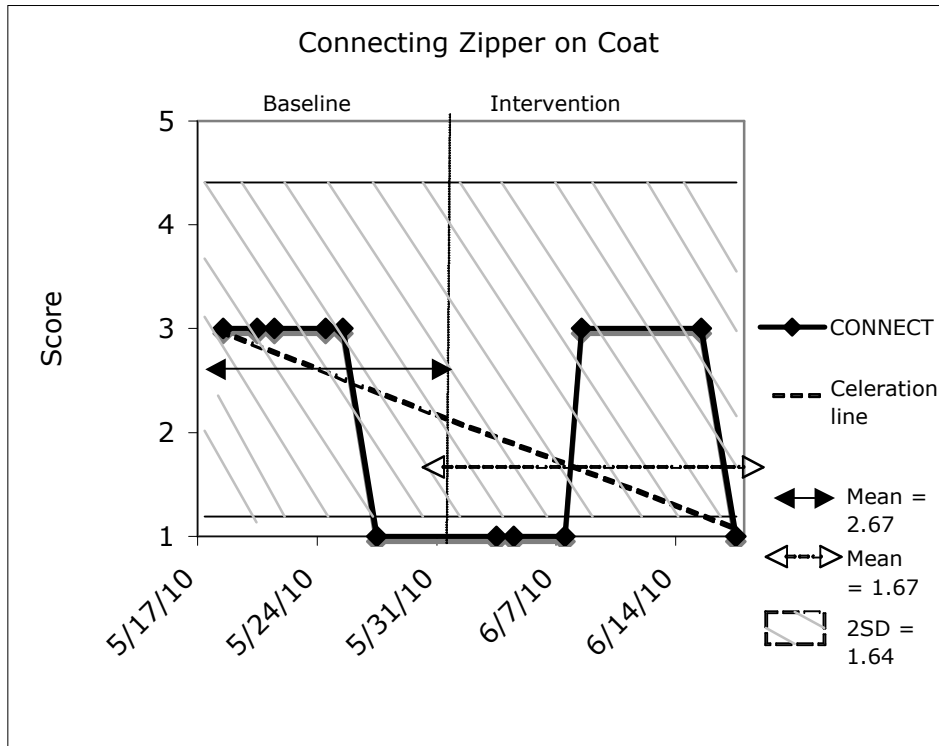


Figure 9. Results of the target behavior of connecting zipper from DV of putting on jacket. *Note.* Only six baseline data collection periods, unconnected line represents missing data collection point for this target behavior.

Appendix A

The questions from the PEDI (Haley et. al., 1992) that were used to rate the self-care abilities of participants being recruited for this study included:

Part I: items marked either as unable or capable

Self Care Domain

- Use of Sporks
 - Finger feeds
 - Scoops with a spoon and brings to mouth
 - Uses a spoon well
 - Uses a fork well
 - Uses a knife to butter bread, cut soft foods
- Handwashing
 - Holds hands out to be washed
 - Rubs hands together to clean
 - Turns water on and off, obtains soap
 - Washes hands thoroughly
 - Dries hands thoroughly
- Pullover/Front-Opening Garments
 - Assists, such as pushing arms through shirt
 - Removes T-shirt, dress or sweater (pullover garment without fasteners)
 - Puts on T-shirt, dress or sweater
 - Puts on and removes front-opening shirt, not including fasteners
 - Puts on and removes front-opening shirt, including fasteners

- Fasteners
 - Tries to assist with fasteners
 - Zips and unzips, doesn't separate or hook zipper
 - Snaps and unsnaps
 - Buttons and unbuttons
 - Zips and unzips, separates and hooks zipper

Social Function Domain

- Problem-resolution
 - Tries to show you the problem or communicate what is needed to help the problem
 - If upset because of a problem, child must be helped immediately or behavior deteriorates
 - If upset because of a problem, child can seek help and wait if it is delayed a short time
 - In ordinary situations, child can describe the problem and his/her feelings with some detail (usually does not act out)
 - Faced with an ordinary problem, child can join adult in working out a solution
- Time Orientation
 - Has a general awareness of time of mealtimes and routines during the day
 - Has some awareness of sequence of familiar events in a week
 - Has very simple time concepts
 - Associates a specific time with actions/events

- Regularly checks clocks or asks for the time in order to keep track of schedule

Parts II and III: using Caregiver Assistance Scale (Part II) and Modification Scale (Part III)

Self-Care Domain

- Eating: eating and drinking regular meal; do not include cutting steak, opening containers or serving food from serving dishes
- Bathing: washing and drying face and hands, taking a bath or shower; do not include getting in and out of a tub or shower, water preparation, or washing back or hair
- Dressing Upper Body: all indoor clothes, not including back fasteners; include help putting on or taking off splint or artificial limb; do not include getting clothes from closet or drawers

Social Function Domain

- Functional Comprehension: understanding of requests and instructions
- Functional Expression: ability to provide information about own activities and make own needs known; include clarity of articulation

Caregiver Assistance Scale

- Independent
- Supervision
- Minimal
- Moderate
- Maximal

- Total

Modification Scale

- None
- Child
- Rehab
- Extensive

Appendix B

Song Lyrics

“If You Want To Go Outside, Get Your Coat”

To the tune of “If You’re Happy and You Know It”

If you want to go outside, get your coat
If you want to go outside, get your coat
If you want to go outside,
If you want to go outside,
If you want to go outside, get your coat.

Now once you’ve got your coat, find the sleeve
And put your hand through the sleeve, through the sleeve
Now once you’ve got your coat,
Now once you’ve got your coat,
Put your hand through the sleeve, through the sleeve

Now find the other sleeve, other sleeve
And put your hand through the sleeve, through the sleeve
Now find the other sleeve,
Now find the other sleeve,
And put your hand through the sleeve, through the sleeve

Now once your coat is on, zip it up
Now once your coat is on, zip it up
Now once your coat is on,
Now once your coat is on,
Now once your coat is on, zip it up

Now we’re ready to go outside, YEE HAW!
Now we’re ready to go outside, YEE HAW!
Now we’re ready to go outside,
Now we’re ready to go outside,
Now we’re ready to go outside, YEE HAW!

“I Go and Wash My Hands”

To the tune of “So Early Sunday Morning”

Before I go and wash my hands,
Wash my hands, wash my hands,
Before I go and wash my hands,
I turn the water on.

Now its time to get some soap,
Get some soap, get some soap,
Now it's time to get some soap,
And make it bubble up.

Then I wash the bubbles off,
Bubbles off, bubbles off,
Then I wash the bubbles off,
Until my hands are clean.

Now I turn the water off,
Water off, water off,
Now I turn the water off,
And then go dry my hands.

Paper towel dries my hands,
Dries my hands, dries my hands,
Paper towel dries my hands,
Then I put it in the trash.

Now that my hands are clean,
Hands are clean, hands are clean,
Now that my hands are clean,
I go sit down for lunch.

“Oh When It’s Time To Eat My Food”

To the tune of “Oh When the Saints Go Marching In”

Oh when it’s time, to eat my food,
Oh when it’s time to eat my food,
I pick the fork up in my hand,
Oh when it’s time to eat my food.

Now that I have, my fork in hand,
I scoop the food onto my fork,
Then I bring it to my mouth,
And eat the food before it falls.

Oh when it’s time, to eat my food,
Oh when it’s time to eat my food,
I scoop the food onto my fork,
Oh when it’s time to eat my food.

Now that I have, my fork in hand,
I scoop the food onto my fork,
Then I bring it to my mouth,
And eat the food before it falls.

Oh when it’s time, to eat my food,
Oh when it’s time to eat my food,
I bring the food up to my mouth,
Oh when it’s time to eat my food.

Now that I have, my fork in hand,
I scoop the food onto my fork,
Then I bring it to my mouth,
And eat the food before it falls.

Oh when it’s time, to eat my food,
Oh when it’s time to eat my food,
I eat the food before it falls,
Oh when it’s time to eat my food.

Appendix C

Coding System for Use of Self-Care Skills Worksheet

DOCUMENTING ACTIVITY LEVEL AND SPECIFIC ACTIVITY

- A. A low activity level (quiet) will be defined as a stationary and/or quiet class with voice levels from whispers to quiet talking.
- B. A medium activity level (active) will be defined as an active class that is moving and participating in activities with voices ranging from quiet to loud.
- C. A high activity level (emotional/loud) will be defined as an extremely active and/or emotional class with children who are running or voice levels that are screaming, crying, etcetera.
- D. The specific activity documented will be no more than one short simple sentence, ex, “_____ was playing cars with one friend.”

PUTTING ON JACKET

- 1. Retrieve coat:
 - a. Dependent/unable if the teacher has to retrieve the coat for the child
 - b. 25% if the child is able to identify their coat correctly but did not retrieve the jacket
 - c. 50% if the child makes a motion to retrieve their coat by pulling on jacket
 - d. 75% if the child attempts to lift the jacket off of hook but is unable to retrieve jacket
 - e. 100% if the child is able to identify and retrieve the jacket themselves
- 2. 1st arm in sleeve / 2nd arm in sleeve:
 - a. Dependent/unable if the teacher has to put the child's arm(s) into the sleeve for the child and pull the child's hand(s) out of the sleeve for them
 - b. 25% if the teacher has to help the child put their hand(s) into the sleeve, but the child is able to help push their hand out of the opposite end of the sleeve
 - c. 50% if the child is able to put their hand into a sleeve hole but unable to push their arm through the opposite end without assistance
 - d. 75% if the child is able to put their hand into a sleeve and push it through to the opposite hole, but the child puts the arm in the incorrect sleeve
 - e. 100% if the child is able to put their hand into the correct sleeve and push it through to the opposite hole without any physical assistance from the teacher
- 3. Connects 2 sides of the zipper:
 - a. Dependent/unable if the teacher has to complete the activity, and the child does not touch either side of coat
 - b. 25% if the child can grasp the 2 sides of the coat but unable to attempt to connect them
 - c. 50% if the child grasps the 2 sides of the coat and attempts to connect them by touching the two hooks together

- d. 75% if the child partially connects the two 2 sides of the coat together, or connects the coat incorrectly
- e. 100% if the child is able to fully connect the coat

4. Zips zipper:

- a. Dependent/unable if the teacher has to completely zip the coat
- b. 25% if the teacher has to zip the coat, but the child makes a motion to grab the zipper
- c. 50% if the child is able to pull the zipper up without physical assistance to at least once inch
- d. 75% if the child is able to pull the zipper up to their stomach but requires physical or verbal cues to completely zip their coat
- e. 100% if the child is able to fully zip it up to their chest without any physical or verbal assistance.

5. Snap snaps

- f. Dependent/unable if the teacher has to connect all snaps
- g. 25% if the teacher has to connect all snaps but the child is able to motion to connect snaps by either pulling one snap close together or attempting to push on a snap
- h. 50% if the child is able to connect at least one snap but the teacher has to connect the rest of the snaps
- i. 75% if the child connects at least 2 snaps but no more then half of the snaps on the jacket without physical assistance, with the remaining to be completed by the teacher
- j. 100% if the child connects more then half of the snaps on their jacket without physical assistance.

- E. If the jacket has either no zipper or no snaps, only one item will be counted and the other item will be counted as “Not Applicable.”
- F. If the jacket has both snaps and a zipper but it is not deemed necessary by the teacher to connect both items, the item that is not observed will be marked as such in the column provided on the worksheet.

HANDWASHING

- G. All items in this category will be marked as either “Yes” or “No, ” if an item was not observed or completed by the teacher then it will be counted as “No.”
- H. To determine if the water was turned on, the water must be a steady stream of water; if the water is dripping, it will be counted as “No.”
- I. To obtain soap, the child must gather at least one pump of soap or rub hands with bar soap.
- J. The child must rub both hands with soap for at least 10 seconds to be counted as a “Yes” for item #8.
- K. To determine if soap is completely washed off, the researcher will observe that no bubbles remain on the child’s hands before they turn the water off, or gather a paper towel to dry their hands. Should bubbles remain, this will be documented in the “No” column.

- L. To observe that the water was turned off, no water will remain dripping from the faucet; otherwise this will be marked as “No.”
- M. To determine if the child’s hands are dry, no water may be observed to be dripping off of child’s hands after they have used the paper towel. Should the child dry their hands with any cloth or clothing other than the paper towel, this item will be marked as “No.”
- N. To determine if the child throws the paper towel away, the paper towel must be thrown into a trash can, should it fall onto the floor or anywhere else this will be marked as “No.”

EATING

- O. The researcher will observe and count the number of times the student uses a spork (either a fork or a spoon) to pick up food and bring it to his/her mouth and mark this information in the space provided.
- P. The total time observation will take place will be the length of the duration of the song. During nonintervention observations, the researcher will use a stopwatch to time the observation; total time observed will be equivalent to the song length. This observation will take place at the beginning of the meal within the first five minutes of eating at every observation period.
- Q. For Item #13, one occurrence will be determined when the student has successfully picked up at least a teaspoon-sized amount of food. This measurement will be judged visually by the researcher.
- R. For Item #14, one occurrence will be determined when the student closes his/her lips onto the spork loaded with food. Should the child place their lips onto the wrong end of the spork, or a spork without food on it, these attempts will not be counted.
- S. Frequency of spork use will be determined by the number of times that spork is picked up during the mealtime, the hand must be placed on the handle of the spork to be counted.

MOOD OF PARTICIPANT

- T. Following completion of the activities the researcher will ask the teacher “How _____’s mood today?” The teacher’s response will be recorded on the worksheet.
- U. The researcher will not document any personal assessments of participant’s mood in this section.
- V. The researcher will document the mood of the participant as reported by the teacher no more than 5 minutes following completion of the three observed self-care activities.

NOTES

- W. Any notes about specific actions observed, whether the subject, teacher or class sung along with the CD, or other significant information, such as activity interrupted by a fire drill, may be documented in the space provided.

End of protocol

Appendix D

Protocol for Data Collection

- A.** After arrival at facility, the researcher will check in with administration at each observation period, and complete all required documentation.
- B.** After entering classroom, the researcher will greet the teacher and students at each observation period.
- C.** The researcher will not interact with the student/teacher during intervention activities.
- D.** The researcher will document the activity level of the class at each intervention period as low, medium or high level. These classifications are defined in the “Protocol for Use of Self-Care Skills Worksheet” in items A through D. This documentation will take place immediately prior to completion of the self-care activities (no more than 5 minutes prior to observation).
- E.** The researcher will also document the specific activity that the child is participating in and the activity level of the child when the researcher immediately enters the class prior to completion of the self-care activities (no more than 5 minutes prior to observation).
- F.** For the category entitled “Putting on Jacket,” the researcher will document the child to be Dependent/Unable (D/UN), 25% Independent (25% I), 50% Independent (50% I), 75% Independent (75% I), 100% Independent (100% I), at each intervention period in the corresponding column.
- G.** If the child was not observed to complete a step in any item in this category, or the data is not applicable, it will be marked as such and not counted in data analysis.
- H.** Items in the “Hand washing” category will be marked as either a check mark in the appropriate column in the space provided.
- I.** More than one column *cannot* be documented for each task in either “Putting on jacket” or “Hand washing” during one intervention period.
- J.** The “Use of Sporks” category will be marked as the number of attempts of each action in the space provided. This will be documented as tally marks.
- K.** The same type of spork will be required to be used at every intervention period for the eating activity.
- L.** The researcher will document the mood of the participant as reported by the teacher no more than 5 minutes following completion of the three observed self-care activities.
- M.** Any notes about specific actions observed, whether the subject, teacher or class sang along with the CD, or other significant information, such as activity interrupted by a fire drill, may be documented in the space provided.
- N.** Prior to exiting class, the researcher will say good-bye to the teacher and students.
- O.** After exiting the classroom, the researcher will sign out at the administrative office and complete any required documentation.
- P.** Any deviation from this protocol will be documented on the Self-Care Skills Worksheet in the notes section for that observation period.

End of protocol

